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OBSERVATIONS OF THE WESTWOOD POLYGAS WOOD WASTE GASIFIER AT CHASM, B.C. DURING THE EXPERIMENTAL CAMPAIGN, SEPTEMBER 12-19, 1978

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by

G.V. Sirianni

SUMMARY

The Westwood Polygas wood waste gasifier produced high-quality, low Btu gas at the rate of about 10 million Btu's/hr for more than 48 hr, however the mechanical reliability of the gasifier was not proven. The most serious mechanical deficiency appeared to be in the rotating hearth. It is hopeful that redesigning the hearth drive mechanism will solve the problems in this area.

INTRODUCTION

The first attempt to demonstrate Phase I was from July 13 to July 21, 1978 (see Report ERP/ERL 78-73 (TR). The objective of that campaign was to produce continuously for one week, gas which contained at least 100 Btu's/scf at the rate of at least 4.5 million Btu's/hr. This quantity according to Westwood Polygas Ltd. was enough to fire one lumber drying kiln.

The objective was not nearly achieved because of mechanical failures and upset operating conditions. The mechanical failures involved the sprocket in the rotating hearth of the reactor. The upset operating conditions, which resulted in much finely divided carbon being carried over to the condensate tank, were probably caused in part by channeling because of the poor porosity of the wood waste.

On August 11, 1978 Mr. Al Fernie, Project Manager for Westwood Polygas Ltd. was notified by telex that: "to achieve the objectives and to complete Phase 1, CANMET requires that the Westwood Polygas Gasifier should

produce continuously for five days gas containing at least 100 Btu's/SCF and at the rate of at least 4.5 million Btu's per hour. Continuation of the project to subsequent Phases, II, III and IV, are subject to the successful operation of the gasifier for 5 days under the above operating conditions. The above work should be carried out at your expense".

Westwood Polygas Ltd. accepted, and another campaign started in September 12, 1978. This report briefly covers the campaign from September 12 to September 19, 1978.

CAMPAIGN SEPTEMBER 12-18, 1978

1. Objective

The main objective was to produce continuously for five days, gas containing at least 100 Btu's/SCF and at the rate of at least 4.5 million Btu's/hr.

2. Mechanical Improvements

The chief mechanical improvements were made to the rotating hearth. The sprocket on the hearth was made secure and plows were installed in the rotating hearth seal to remove carbon accumulation.

3. Feed

Wood chips were used in place of wood waste (bark, planar shavings, saw dust and bits and pieces of lumber). The chips varied in size from about 1/2 in. x 1/2 in. x 1/4 in. to about 3 times that size. The wood chips were expected and did provide good, uniform porosity in the reactor.

4. Operation of the Gasifier

The gasifier was started about 1600 hr on September 12, 1978. By 2055 hr acceptable gas was produced and continued to be produced until about 0400 hr on September 15 when the chain that drove the rotating hearth broke. During that period the gas quality was high and operating conditions such as air and steam input to the gasifier were steady. The porosity in the reactor was excellent as indicated by the pressure drop across the reactor. The pressure drop never exceeded 26 in. water and most of the time it was in the 10 to 20 in. range. The previous campaign at times, the pressure drop was above the instrument scale limit

(100 in. water). The rate of gas production was about 10 million Btu's/hr. Samples of gas taken during this period are listed in the Appendix.

A new chain arrived from Vancouver about 0100 hrs on September 16 and installation was complete by about 1100 hr. Within 24 hr after its installation the hearth seized. Apparently the hearth drive became hot again and the chain stretched, (about 5%), jammed, and seized the drive.

The gasifier was restarted on September 17 on the afternoon shift without the hearth rotating. The campaign ended on September 19 at about 1630 hrs. During this period (September 17 to September 19) the feed was changed from chips to wood waste. This part of the campaign would not be too significant because the hearth was not rotating.

SUMMARY

Although the gasifier produced high quality low Btu gas at a rate of about 10 million Btu's/hr for more than 48 hr, the mechanical reliability of the gasifier has not been demonstrated.

RECOMMENDATIONS

As things stand now there is not much point in continuing with the reactor in the present condition. Mr. Al Fernie feels that the hearth should be redesigned. One proposed modification is to equip the hearth with a sprocket with heavy teeth which would be driven by a hydraulic ram.

It was agreed that Westwood should summarize the work done in the July and September campaigns. Also they should include the modifications proposed to the gasifier and their estimated cost.

If CANMET agrees to the changes, then a new work statement would be required. Mr. Fernie stated that if CANMET agreed to fund the changes, they would perform the five day run at their expense. Decisions concerning these proposals can be made after the cost estimates are received.

APPENDIX A

Summary of Gas Analyses

Date Sept.	Time	Sample No.	Gas Composition (%) Dry Basis							Btu's cu ft dry basis	Remarks
			H_2	O_2	N_2	CO	CH_4	CO_2	C_2*		
12	2010	1	3.06	13.6	7.07	4.38	0.59	5.65		30	
	2055	2	8	1.43	53.8	15.5	2.61	14.0	0.97	118	
	2155	3	10.9	0.33	57.2	18.7	1.5	12.4	0.61	120	
	2300	4	10.7	0.08	51.3	24.8	1.73	9.3	0.47	140	
13	0815	5	13.1	0.2	44.6	27.8	1.98	7.1	0.37	158	
	0900	6	14.3	.05	42.1	30.5	2.21	6.9	0.43	174	
	0930	7	15.1	.05	41.2	30.7	2.43	7.7	0.55	182	
	1025	8	16	.05	40.4	28.4	2.5	9.1	0.52	178	
	1102	9	15.3	.05	42.1	24.2	3	12.2	0.63	168	
	1145	10	15.3	.05	40.4	30.9	2.43	6.9	0.46	181	
	1330	11	15.3	.05	41.2	31.9	2.1	6	0.36	180	
	1355	12	14.9	.05	42.9	30.7	2	6.3	0.33	173	
	1435	13	15.8	.05	40.4	30.9	2.73	6.3	0.42	186	
	1615	14	15.8	.05	40.6	33.3	2.76	6.2	0.44	191	
	1830	15	15.5	.05	41.2	31.8	2.51	7.3	0.41	185	
	1925	16	14.5	.05	40.4	31.4	2.81	7.65	0.47	185	
	1950	17									values unavailable.
14	0815	18	15.3	.05	42.1	32.2	2.32	6.0	0.33	182	
	0840	19	15.1	.05	42.1	31.8	2.41	6.4	0.39	182	
	0910	20	16.7	.05	39.7	30.9	3.01	7.3	0.46	192	
	0932	21	12.9	.05	48.4	25.7	2.06	9.4	0.30	151	
	1005	22	13.3	.05	48.4	26.9	1.93	8.2	0.28	154	
	1050	23	15.2	.05	44.9	27.6	2.3	7.8	0.34	167	
	1125	24	14.6	.05	44.9	28.2	2.03	7.4	0.34	165	
	1255	25	12.7	.05	50.1	25	1.96	9.8	0.31	147	
	1335	26	15.4	.05	44.1	31.4	2.08	6.35	0.34	178	
	1410	27	13.9	.05	47.1	24.8	2.18	10.1	0.37	153	
	1500	28	12	.05	53.5	20.8	1.72	12	0.3	128	Shut down from 1425 to 1450 hr to remove ash.

* Gases such as acetelyne and ethane

APPENDIX A

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Date Sept.	Time	Sample No.	Gas Composition (%) Dry Basis							Btu's cu ft dry basis	Remarks
			H_2	O_2	N_2	CO	CH_4	CO_2	C_2*		
14	1532	29	13.8	.05	46.2	23.1	2.61	11.8	0.38	152	
	1630	30	15.7	.05	47.9	24.1	1.77	9.7	0.27	151	
	1700	31	16.4	.05	45.5	26.8	1.91	7.6	0.33	165	
	1730	32	13.9	.05	45.8	30.1	1.79	6.25	0.31	165	
	1755	33	14.95	.05	44.5	32.4	1.94	5.35	0.36	178	
	1825	34	13.3	0.05	46.2	31.6	1.65	4.9	0.28	166	
	1845	35	14.6	0.05	48.4	27.6	1.79	7.8	0.26	159	
15	0400										Chain drive seized.

* Gases such as acetelyne and ethane